

# CM3106 Multimedia

Prof David Marshall

`dave.marshall@cs.cardiff.ac.uk`

and

Dr Kirill Sidorov

`K.Sidorov@cs.cf.ac.uk`

`www.facebook.com/kirill.sidorov`



School of Computer Science & Informatics  
Cardiff University, UK

## Lecturers

- Prof David Marshall (1st Half)
- Dr Kirill Sidorov (2nd Half)

# About This Course

- 20 Credit Module
- Lectures — Online Videos, Slides and **MATLAB Live Scripts: Experiential Learning**
- Tutorials
- Lab — 2 hours per week. *from Week 2*
  - MATLAB Live Script based Lab Sheets: **Experiential Learning**

## Assessment

- Online Exam 50%
  - **Kirill Sidorov Half**: Exam Period.
- Coursework 50%: 1 Piece:
  - **Dave Marshall Half**: Handout Week 3

**One** piece

- 1 MATLAB programming: Digital Audio based (DM)
  - Digital Synthesis
  - Digital Signal Processing

**All Tutorials and Lab Classes support coursework**

# Relationship with previous modules

- MATLAB will be used for examples and demos;
  - Basics covered in CM2104/CM2208
  - further practice in lab classes this year.
- Difficult maths already covered in CM2104/CM2208!
  - We'll revise some of it in due course.
    - **Don't miss Week 1/2 Revision Material!**

## Learning Central

- Weekly Schedule
- Main links to learning material
- Course Videos.
- Links to below Web pages

# Course Material

Course Web Page:

<https://users.cs.cf.ac.uk/Dave.Marshall/Multimedia/>

- Under Re-Development
- MATLAB Scripts and Code
- Lab and Coursework material.
- PDF — Additional Notes.
- Past Exam Papers
- Lots of Links to other material

# Outline of Course

- Basic grounding in issues surrounding multimedia,
- Multimedia data:
  - Digital audio, graphics, images and video, etc.,
  - Underlying concepts and representations of sound, pictures and video,
  - Audio/Digital signal processing fundamentals — filtering, audio synthesis
- **Follows on from CM2208**
- Data compression — JPEG/GIF, MPEG video and MPEG Audio.
  - Core data compression algorithms in JPEG/MPEG etc.
- Transmission and Integration of media.
- Multimedia applications: e.g. content based retrieval.

# Practical Work 1 (Coursework)

A small assessed practical programming “mini-project” based on **Multimedia digital audio synthesis/signal processing**.

## **Important Dates:**

Hand Out: Week 3

Hand In: Week 10

## **MATLAB Programming Examples and Coursework**

All module lecture/tutorial examples and the programming elements of the coursework will use **MATLAB**.

# Outline of Module Delivery (1)

## Lectures

- Focus on main theory of module.
- Lots of **Demos**:
  - Essential help for Assessed Coursework
  - MATLAB Examples explained in depth
  - **Interactive**:
    - Live MATLAB Code examples.
    - **Questions at any time please.**

Via StackOverflow.

# Outline of Module Delivery (2)

## Lab Classes:

- All driven via **MATLAB Live Scripts**
- MATLAB programming help sessions
- Try out Lecture/Tutorial examples
- Extended reasoning and programming through Lab Worksheet Questions
- Build a solid basis for Assessed Coursework

If you have any comments, questions or queries on any part of this module please send them via [COMSC's StackOverflow](#) site.

- Any issues, questions on the lecturers or understanding of any part of the module,
- Any questions on any lab exercise, coursework etc.
- If you find any errors please let us know too.

## Please tag:

- Any comments, questions or query with the tag "CM3106".
- Specific module lecturer (Dave Marshall or Kirill Sidorov) or the lab tutor (Stefano Zappala), if appropriate
- Also, things like topic or lab class or coursework related tags.

# Syllabus Outline

Topics in the module include the following:

- Introduction: Multimedia applications and requirements
- Multimedia data acquisition and formats: Audio, Graphics, Images and Video
- Audio/Video fundamentals including analog and digital representations, human perception, and audio/video equipment, applications.
- Digital Audio signal processing, Image/Video Processing.
- Digital Audio Synthesis: Basic audio synthesis techniques
- MIDI: Basic MIDI definitions, MIDI control of audio synthesis, MIDI and data compression (MPEG4)

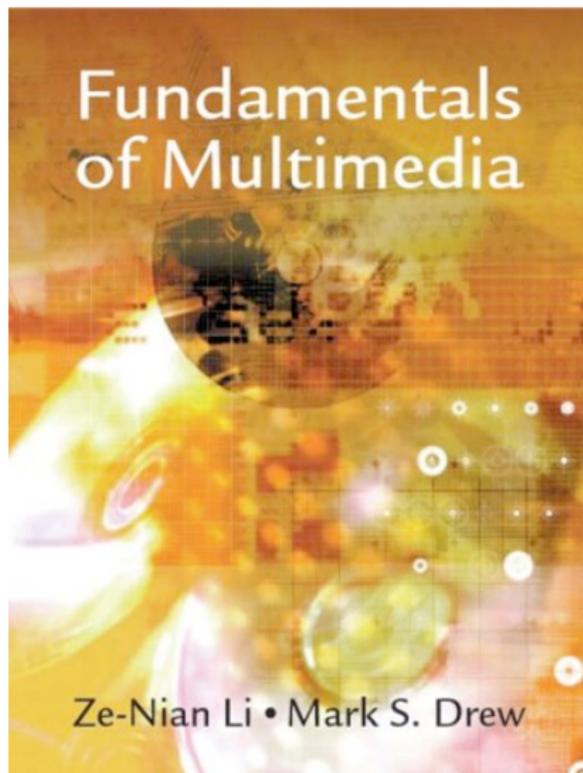
- Audio and video compression
  - Lossy v. Lossless Compression
  - Information Theoretic Transform  
(Huffman Coding, Arithmetic Coding, LZW/GIF)
  - perceptual transform coders for audio/images/video  
(Fourier, DCT, Vector Quantization)
  - Image and video compression applications and algorithms:  
JPEG, H.263, MPEG Video, MPEG Audio,
- Multimedia applications
  - Content based multimedia retrieval (audio & video)

# Recommended Course Book

Fundamentals of Multimedia  
Ze-Nian Li, Mark S. Drew  
Prentice Hall, 2003  
(ISBN: 0130618721)

*Decent coverage all  
major aspects of the course  
plus a lot more*

**No MATLAB Examples**  
**Copies in library**



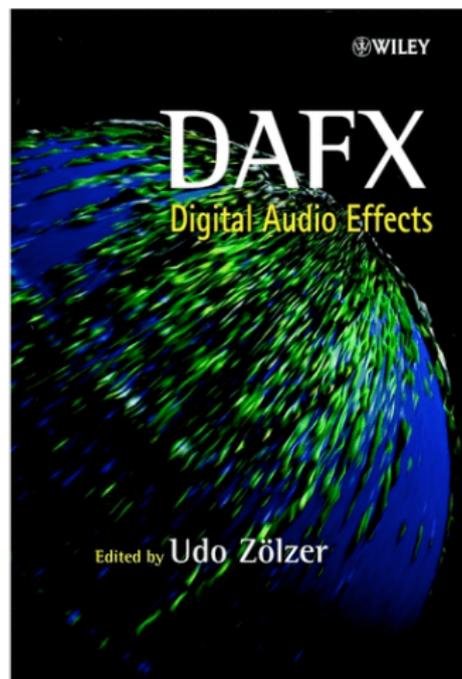
# Other Texts Used In This Module: Practical MATLAB Based

DAFX: Digital Audio Effects  
Udo Zölzer  
John Wiley and Sons Ltd ,  
2002  
(ISBN-13: 978-0471490784)

*Excellent coverage of audio  
signal processing effects and  
synthesis*

*plus a lot more*

**All MATLAB examples**  
**Expensive but copies in  
library**



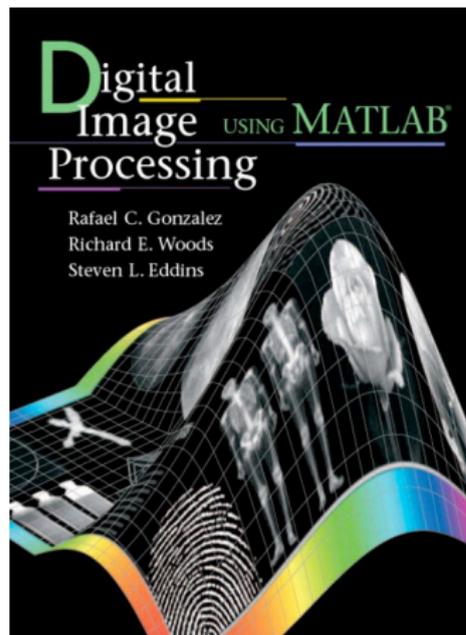
# Other Texts Used In This Module: Practical MATLAB Based

Digital Image Processing Using  
MATLAB

Rafael C. Gonzalez,  
Richard E. Woods,  
and Steven L. Eddins  
Prentice Hall, 2004  
(ISBN-13: 978-0130085191)

*Excellent coverage of Image  
processing examples*

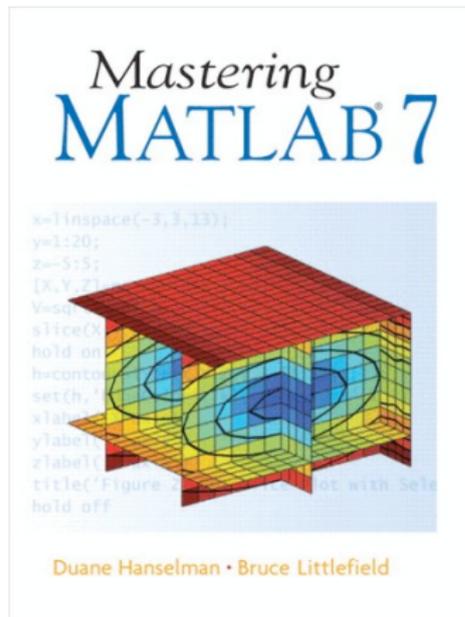
**All MATLAB examples**  
**Copies in library**



# Other Texts Used In This Module: Practical MATLAB Based

Mastering MATLAB  
Duane C. Hanselman and  
Bruce L. Littlefield  
Prentice Hall, 2004  
(ISBN-13: 978-0131857148)

*Excellent coverage of Basic  
MATLAB programming*  
**Copies in library**



# Other Texts Used In This Module: Audio Synthesis

Sound Synthesis and Sampling  
(Third Edition)

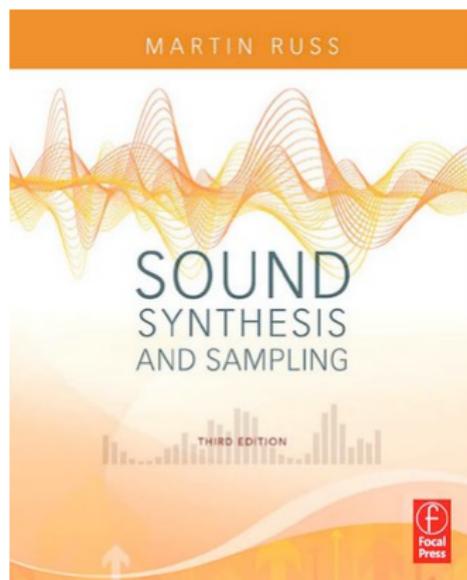
Martin Russ

Focal Press

(ISBN-13: 978-0240521053)

*Good coverage of basic  
synthesis algorithms*

**Copies in library**



# Other Texts Used In This Module: Compression Algorithms

Data Compression: The Complete Reference (Fourth Edition)

David Salomon

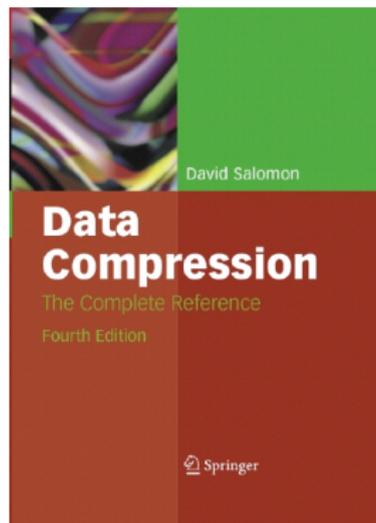
Springer-Verlag London, 2007

(ISBN: 978-1846286025)

*Comprehensive coverage of all compression algorithms and formats.*

*Many more than covered in this course!*

**Expensive but Copies in library**

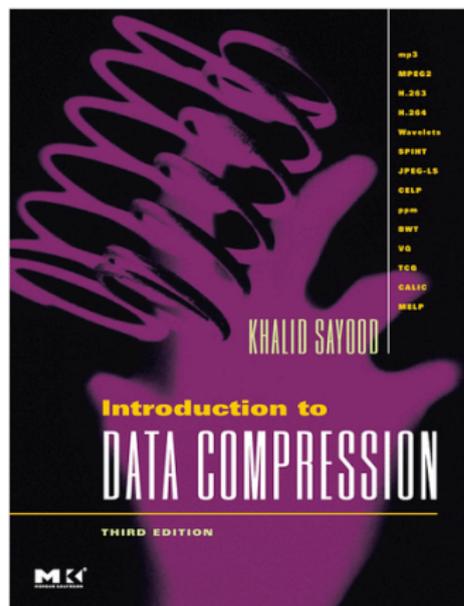


# Other Texts Used In This Module: Compression Algorithms

Introduction to Data  
Compression (3rd Edition)  
Khalid Sayood  
Morgan Kaufmann, 2005  
(ISBN-13: 978-0126208627)

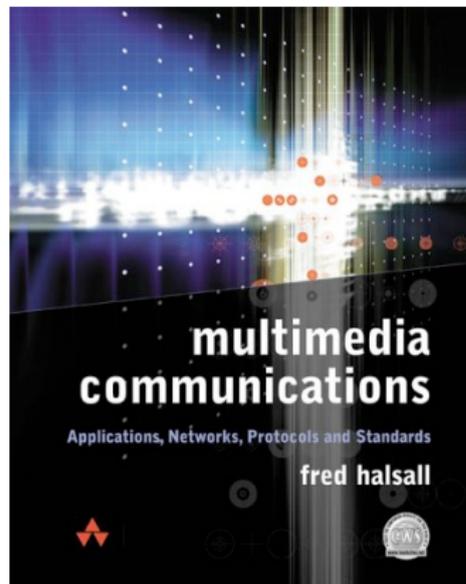
*Excellent coverage of all  
compression algorithms and  
formats*

**Example code but not  
MATLAB  
Copies in library**



# Other Good General Texts

Multimedia Communications:  
Applications, Networks,  
Protocols and Standards,  
Fred Halsall,  
Addison Wesley, 2000  
(ISBN 0-201-39818-4)



# Other Good General Texts

The following books are highly recommended reading:

## **Digital Audio**

- A programmer's Guide to Sound, T. Kientzle, Addison Wesley, 1997 (ISBN 0-201-41972-6)
- Audio on the Web — The official IUMA Guide, Patterson and Melcher, Peachpit Press.
- The Art of Digital Audio, Watkinson, Butterworth-Heinmann.
- Synthesiser Basics, GPI Publications.
- Signal Processing: Principles and Applications, Brook and Wynne, Hodder and Stoughton.
- Digital Signal Processing, Oppenheim and Schaffer, Prentice Hall.

# Other Good General Texts: Digital Imaging/Graphics/Video

- *Digital video processing*, A.M. Tekalp, Prentice Hall, 2005.
- *Encyclopedia of Graphics File Formats*, Second Edition by James D. Murray and William van Ryper, 1996, O'Reilly & Associates.

## Data Compression

- *The Data Compression Book*, Mark Nelson, M&T Books, 1995.